

A Copper-Iron Replacement Reaction

Modified and Adapted by Genesis Hearne and John Magner, Ph.D

The reaction between a solution of copper sulfate and an iron nail is a typical example of a single replacement reaction. Single replacement reactions involving the replacement of metal ions take on the following general form:



where A and B are metals and C is the nonmetal or polyatomic anion. Some specific examples of this type of reactions are:



Notice that the solid metal reactant in each equation changes to an ionic form as a product and that the ionic reactant changes to the solid, elemental form in each equation.

Copper ion forms a deep blue aqueous solution. When a strip of Zn is placed in an aqueous CuSO_4 solution, the blue color will slowly disappear as the zinc reacts and copper metal is produced.

In this experiment, you will be using a blue copper sulfate solution and an iron nail as reactants. After the reaction is complete, you will have a yellow/green solution, some precipitated metallic copper, and some iron nail left over. From the mass of the copper produced and the iron reacted, you will determine the mole ratio of copper produced to iron reacted. Iron can form two stable ions, Fe^{2+} and Fe^{3+} ; from the mole ratios you obtain in the experiment, you will be able to determine which ion is formed so that you can write the correct balanced equation for the reaction.

Background:

A mole is the term used for Avogadro's number of "things" where Avogadro's number is 6.022×10^{23} and "things" can be anything but generally refer to atoms or molecules. For this experiment, you need to understand two aspects of the mole concept: first, the conversion of mass to moles and vice-versa; and second, mole ratios in chemical reactions.

1. Conversion of mass to moles and moles to mass:

To calculate the number of moles of a substance, you must first calculate its molar mass. To do this, simply add together the molar masses of each of the elements in the compound times the number of atoms of that element in the formula. For example:

The total mass of: $\text{Ca}(\text{NO}_3)_2$
is found by: $40.1 + 2(14.0 + 3(16.0)) = 164.1 \text{ g/mol}$

Answers To Copper Reaction Lab Report

**William Crookes, James H.
Gardiner, Gerald Druce, H. W. Blood-
Ryan**

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Publications, Reports, and Papers for 1965 from Oak Ridge National Laboratory K.O. Johnsson, A.S. Haas, 1966
Chemical Committee Report American Gas Association. Technical Section, 1936 *Chemistry Education in the ICT Age*
Minu Gupta Bhowon, Sabina Jhaumeer-Laulloo, Henri Li Kam Wah, Ponnadurai Ramasami, 2009-07-21 th th The 20
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